

Three new Species of the Earthworm Genus *Plutellus* s. strict. (Megascolecidae: Oligochaeta) from New South Wales and Queensland

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Three new species of the restricted genus *Plutellus* are described, elevating the generic total to eight species, to which a key is provided. The new forms further consolidate the genus as a distinct and homogeneous eastern Australian entity. All the new species are characterized by only two pairs of spermathecae, and the two sympatric New South Wales forms are shown to possess only three pairs of calciferous glands, requiring amendment of the generic definition. The close overall resemblance of one of the latter species to the previously-described *Heteropodrilus lamingtonensis* emphasizes the tenuous distinction existing between the two genera, namely, the presence or absence of calciferous stalks. *Plutellus* is viewed as the apomorph sister-group of *Heteropodrilus*, with the insular *Paraplutellus* constituting a yet further derivation.

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INTRODUCTION

The large circum-mundane genus *Plutellus* has for some years been recognized as an ill-defined species-aggregate (Gates, 1961; Jamieson, 1971a), with a distribution encompassing India, Burma, Australia, New Caledonia, New Zealand, Guatemala and a northern portion of South America. Considerable doubt has been shed on the true origin of material of the type-species, *P. heteroporus* Perrier 1873, supposedly Pennsylvanian, but now assumed to be Australian. On the basis of detailed morphological examination, Jamieson (1970, 1971b) found that *P. heteroporus* must be considered strictly congeneric with the New South Wales species, *Cryptodrilus manifestus* Fletcher 1889. Of particular significance was the mutual possession of distinctly stalked calciferous glands, and a regular alternation of the nephridiopores (the latter condition also seen in the endemic Australian *Heteropodrilus* Jamieson, 1970). Accordingly, *Plutellus* was tentatively restricted to Australian forms exhibiting a considerably refined combination of morphological characters.

Some 44 species of Australian earthworm conforming to the 'classical' *Plutellus* definition (requiring only the possession of the lumbric condition of setae, male pores united with or near the pores of a single pair of tubular prostates, and holonephry throughout and as summarized in Jamieson, 1971a), have, in part, been redistributed amongst other Australian genera with possible phyletic affinities with *Plutellus* s. strict. The residue are non-Plutelloid s.s., and are likely to be almost entirely absorbed into the extensive genus *Diporochoaeta*.

Two additional *Plutellus* s. strict. species have been recently described from Queensland (Jamieson and Nash, 1976), bringing the generic total to 5 (including a species from Lord Howe Island). The present paper deals with three additional species, two of which are from northern New South Wales, and one from southeast

Queensland. These forms further consolidate the concept of a restricted, purely Australian *Plutellus*, as herein re-defined.

SYSTEMATICS

Genus *Plutellus* Perrier, 1873, Emend.

Small to moderately large terrestrial worms (37-410 mm long), with c. 100-300 segments. Prostomium epilobous to tanylobous. Dorsal pores commencing at 4/5-8/9. Setae 8 per segment, in regular longitudinal rows, commencing on II; ventral setal couples (*ab*) wide, dorsal setal couples (*cd*) significantly wider and only a little smaller than, or not significantly different from the intervening distance (*bc*); dorsal median intersetal distance (*dd*) 0.20-0.35 of the circumference (*U*). Nephropores large, a pair anteriorly in each segment, commencing with II; alternating segmentally from the vicinity of *b* to *d* lines from V-X posteriorly, sometimes in an asymmetric pattern, one side with respect to the other; in more anterior segments in *c* and *d*, commencing in either setal line in II, and persisting in one or the other location for some consecutive segments. Clitellum annular, on XIV-XVII or part of XIII also. A pair of combined male and prostatic pores on XVIII in line with the ventral setal couples. The prostates with thickly tubular or racemose glands and strongly muscular, ectally dilated ducts (sometimes cylindrical and less muscular); vasa deferentia joining either the duct or the glandular portion of the prostate. Penial setae absent. Accessory genital markings present. Spermathecal pores two to five pairs, the last at mid-IX or, more commonly at the anterior margin of that segment.

Some pre-clitellar septa strongly thickened. Gizzard strong, in V. Large, paired reniform calciferous glands with moderate to long ducts, three or four pairs, in X-XIII; intestine beginning in XV, or, individually, XVI, muscular thickening and typhlosole absent. Dorsal blood vessel single, continuous onto the pharynx. Supraoesophageal vessel present or absent. Dorso-ventral commissural vessels in V or VI to XII or XIII, those in X-XII, XI-XIII, or X-XIII respectively forming laterooesophageal hearts, each of which receives two connectives, one from the supraoesophageal vessel or the calciferous vessels, the other from the dorsal vessel. Subneural vessel (always?) absent. Nephridia stomate, vesiculate and exonephric. Pharyngeal tufting absent. Bladders elongate-subspherical or bilobed; the first pair in II. Testes and funnels either free in X and XI or enclosed in a pericardiac testis-sac; seminal vesicles in IX and XII. Ovaries and funnels in XIII; ovisacs absent(?). Spermathecae 2-5 pairs, each with a digitiform to clavate diverticulum which may be bifid or duplicated.

Diagnosis: Holonephric with large nephridial bladders; nephropores in *c* or *d* lines, and from V-X posteriorly, alternating from *b* to *d* lines. 3-4 pairs of discretely stalked reniform calciferous glands in X or XI-XIII. Combined pores of a pair of tubular or racemose prostates and the vasa deferentia in XVIII.

Type Species: *Plutellus heteroporus* Perrier, 1873.

Distribution: Eastern subregion of Australia: New South Wales, south-eastern Queensland, Lord Howe Island.

CHECKLIST OF SPECIES

1. *Plutellus clarkei* sp. nov. New South Wales.
2. *P. heteroporus* Perrier, 1873. Locality unknown, ? N.S.W.
3. *P. hutchingsi* Jamieson, 1977. Lord Howe Island.
4. *P. incommodus* Jamieson and Nash, 1976. Queensland.

5. *P. manifestus* (Fletcher, 1889). New South Wales.
6. *P. minyoni* sp. nov. New South Wales.
7. *P. notatus* sp. nov. S.E. Queensland.
8. *P. raveni* Jamieson and Nash, 1976. S.E. Queensland.

KEY TO SPECIES

1. 5 pairs of spermathecal pores, at anterior margins of segments V-IX 2
3 to 4 pairs of spermathecal pores, at anterior margins of segments VI or VII-IX 3
2 pairs of spermathecal pores 4
- 2(1) Spermathecal pores in *b* lines. Last hearts in XII *P. heteroporus*
Spermathecal pores in *a* lines. Last hearts in XIII *P. hutchingsi*
- 3(1) Spermathecal pores 4 pairs, almost contiguous mid-ventrally *P. manifestus*
Spermathecal pores 3 pairs, in or slightly median of *b* lines 6
- 4(1) 4 pairs of calciferous glands. Series of postclitellar accessory markings absent *P. notatus* sp. nov.
3 pairs of calciferous glands. A series of median postclitellar accessory markings present 5
- 5(4) Large worms (>300 mm in length). Spermathecal pores close to the anterior margins of 7/8 and 8/9. Supra-oesophageal vessel paired *P. minyoni* sp. nov.
Small worms (<120 mm in length). Spermathecal pores slightly presetal in VIII and IX. Supra-oesophageal vessel single *P. clarkei* sp. nov.
- 6(3) Female pores paired (exceptionally united midventrally). Dorsal median intersetal distances (*dd*) in segment XII \div 3.6 times the width of the ventral setal couples (*ab*). Prostate duct short and straight *P. incommodus*
Female pore single (exceptionally paired). Dorsal intersetal distances (*dd*) in segment XII \div 4.7 times the width of the ventral setal couples (*ab*).
Prostate duct long and sinuous *P. raveni*

Plutellus clarkei sp. nov.

Figs 1A, 2C, E, Table 1.

l = 96, 81 mm; w (midclitellar) = 3.8, 3.4 mm; s = 154, 150 (H., P1). Uniformly circular in cross-section throughout, pigmentless buff in alcohol. Prostomium tanylobous, peristomium much furrowed. First dorsal pore 5/6 (6/7 in P1). Setae *a* and *b* absent from XVIII. Nephropores distinctly visible; in II-IV in *d*-lines, V-VII in *c*, VIII in *d*, IX in *c*, X in *d*, XI in *c*, XII in *d*, XIII in *b*, thereafter alternating regularly between *d* and *b* throughout; in P1 a similar sequence, but with regular alternation commencing with first *b*-line pore in XI. In P2 there is an asymmetric sequence as follows: *right side*: II-XI (*d, d, d, c, c, d, c, d, b, d*, et seq.); *left side*: II-XIV (*d, d, d, c, c, c, d, c, d, d, b, d*, et seq.); this asymmetry continues throughout. Clitellum annular, faintly developed over XIV-XVII; intersegmental furrows, dorsal pores or setae not obscured. Male genital field (refer to Fig. 1A): A series of 4 broad, tumid pads extending longitudinally across the segment, and laterally to slightly beyond *b*-lines present in XVII-XX; each bears a varying number of small, glandular, dimple-like markings. Male pores are visible as minute orifices in *b*-lines, each pore with a dimple-like marking immediately anterior to it. A pair of broad mid-ventral pads similar to those in XVII-XX is present in X and XI; these also

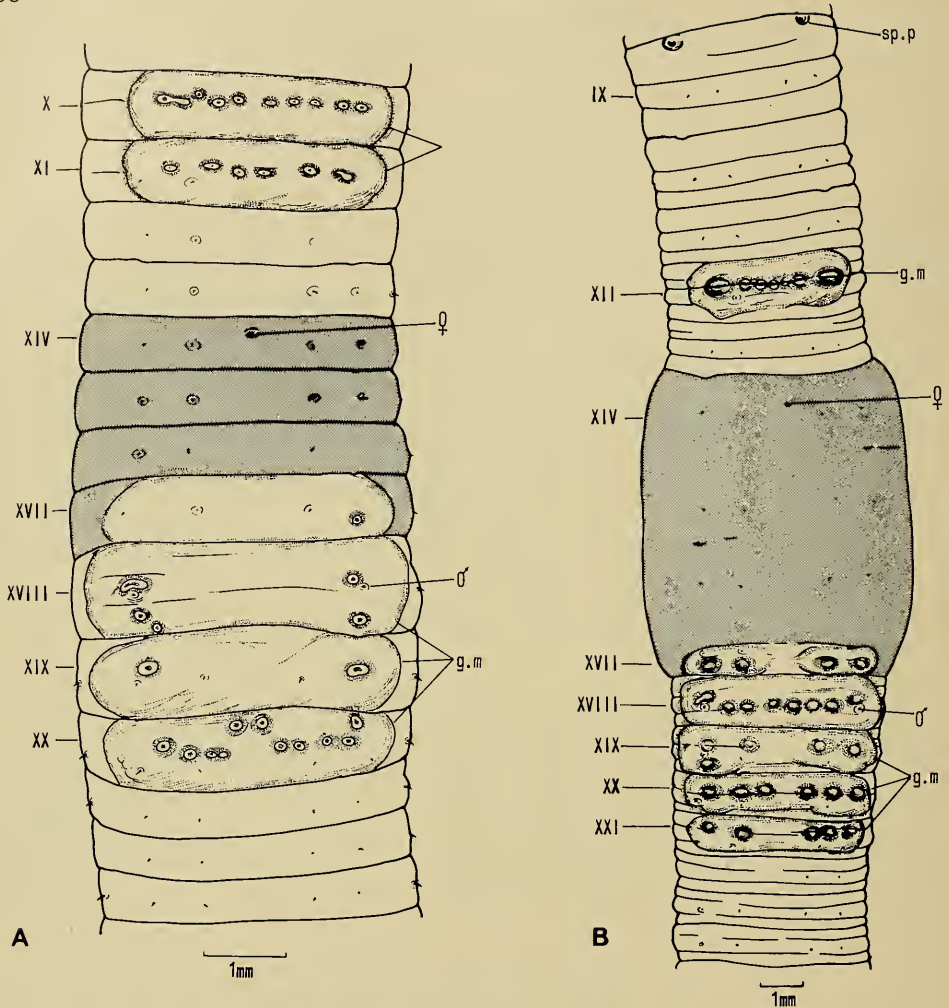


Fig. 1. Genital fields; A — *P. clarkei* (Holotype), B — *P. minyoni* (Holotype).

bear rows of dimples. Female pore faint, unpaired median, slightly presetally in XIV. Spermathecal pores on small papillae, presetally in VIII and IX, slightly lateral to *b*-lines.

Septa: 5/6 diaphanous, 6/7 thin, 7/8 with slight thickening, 8/9-10/11 moderately-strongly muscularized, 11/12 slightly thickened, remainder thin. Dorsal blood vessel single, continuous onto the pharynx, bifurcating under the brain. Last hearts in XIII; only commissurals XI-XIII are distinctively heart-like, though the remainder are still quite large, decreasing in size anteriorly. Commissurals X-XIII may be considered latero-oesophageal, receiving a short, thick, connective from a prominent latero-calciferous trunk on each side, and a much thinner connective from the dorsal vessel. The calciferous vessels fuse in the mid-dorsal line to form a prominent supra-oesophageal vessel. Beginning in mid-XIII, this vessel runs forwards to XII, to join the point of fusion of the latero-calciferous trunks in that segment. In H., there is no apparent continuity of the supra-oesophageal forward to 11/12, though

this is discernible in P1. Thereafter, the vessel continues anteriorly through XI to X, where it terminates at or near 9/10. A paired sub-oesophageal vessel supplying the calciferous glands is present. Gizzard large, cylindrical, and well vascularized, in V; though obviously muscular, it is somewhat compressible, with a conspicuous anterior rim. Oesophagus of moderate width, well vascularized, over VI-XIV; 3 pairs of flattened-discoid (almost reniform) calciferous glands present ventrally in XI-XIII. (In H., the middle pair, in XII is greatly reduced, appearing like simple oesophageal pouches; in both paratypes, however, normal glands are present, suggesting that the condition seen in the Holotype should be regarded as an abnormality). Each highly vascular, lamellate gland is attached dorso-laterally to the oesophagus by a long, though broad, stalk. Intestine commences abruptly in XV, typhlosole absent. Nephridial bladders crinkled, somewhat lobulated, those overlying the dorsal-most nephropores (i.e. in *d*-lines) more pronounced than the other series. Holandric; 2 pairs small-medium sized sperm funnels, and flocculent sperm masses in X and XI; 2 pairs of racemose seminal vesicles in IX and XII. Septa 9/10, 10/11 and 11/12 are joined dorsally by a thin, but definite, pericardial testis-sac. Vas deferens not traceable, excepting in XVII-XVIII; prostates simple tongue-shaped lobes in H. (simple S-shaped in P1, extending into XIX), restricted to XVIII, with a short, but much coiled duct entering the parietes in that segment. The unpaired vas deferens enters the glandular portion of the prostate ventrally, a little distance from the point of visible origin of the duct. (Refer to Fig. 2C). Ovaries a discrete sheaf of small oocytes, and large funnels, in XIII; ovisacs absent. Spermathecae 2 subequally sized pairs in VIII and IX, discharging anteriorly in their segments. Each comprises a tubular ampulla, with long bent duct (of ill-defined origin), and (in rt. IX, H.) a single, uniloculate, inseminated, digitiform diverticulum, arising approximately midway along the length of the duct. Length right spermatheca of IX = 1.78 mm; length spermatheca: length of duct = 4.5; length of spermatheca: length of diverticulum = 3.00. (Refer to Fig. 2E). Considerable variation exists as to the number and nature of the spermathecal diverticula; in H., the left IX spermatheca diverticulum is flattened, and appears biloculate; in right VIII, there are 2 quite discrete diverticula; in P1 all but left IX spermathecae have 2 diverticula.

TABLE 1

Intersetal Distance in Segment XII expressed as a Percentage of the Circumference (U).

<i>Plutellus clarkei</i>	aa	ab	bc	cd	dd	dc	cb	ba	U (mm)
Holotype	12.45	5.36	11.26	12.08	30.06	11.55	11.71	5.53	9.65
AM W6646	12.78	5.36	10.46	10.13	32.66	11.81	10.55	5.74	9.37
QM G8913	13.51	5.90	11.95	12.87	25.90	11.59	11.99	6.29	9.92
\bar{X}	12.91	5.71	11.22	11.69	29.54	11.65	11.42	5.85	
<i>Plutellus minyoni</i>									
Holotype	13.02	6.39	7.13	13.64	32.55	13.76	7.07	6.39	12.80
<i>Plutellus notatus</i>									
Holotype	10.68	5.41	12.99	14.24	22.57	13.39	15.31	5.41	11.10
QM G8914	9.77	5.20	15.06	12.33	25.64	12.53	14.26	5.20	13.75
QM G8915	10.42	4.71	15.02	10.53	28.80	11.24	14.97	4.30	14.52
\bar{X}	10.29	5.11	14.36	12.37	25.67	12.39	14.85	4.97	

Material Examined: From 153° 24'E, 28° 37'S. Scrubland at the top of the Minyon Falls, Whian Whian State Forest, approx. 12 km SW of Mullumbimby, N.S.W., under *Casuarina*, *Eucalyptus pilularis*, and shrubby understorey, with extremely dense litter layer on the soil. Soil rocky in patches, formed on rhyolite. Coll. G. Dyne and H. Clarke, 19 Mar 1978. Holotype (AM W6645), P1 (AM W6646), P2 (QM G8913).

Remarks: The combination of 3 pairs of calciferous glands, posteriorly shifted spermathecal pores (2 pairs only), and single supra-oesophageal blood vessel distinguishes this species from the remainder of the genus. Morphologically, apart from the size discrepancy, *P. clarkei* is very similar to its sympatric congener, *P. minyoni*. The comparatively close conformity in, amongst other characters, the general appearance of the genital fields and setal ratios, suggests that reproductive isolation between the two populations has been a relatively recent process. In this instance, as in the case for the vast majority of earthworm species where breeding data are unavailable, specific integrity is assumed if (a) consistent morphological differences indicate a lack of gene flow between any 2 populations; (b) consistent major discrepancies exist either in size and/or the configuration of the genital fields as to preclude the operation of a specific mate recognition system (sensu Patterson, 1978).

Plutellus minyoni sp. nov.

Figs 1B, 2A, B, D. Table 1.

l = 410 mm; w (midclitellar) = 3.3 mm; s = 387. Form long, relatively thin, whitish in life, pigmentless buff in alcohol. Prostomium epilobous $\frac{1}{2}$ - $\frac{1}{2}$, closed, peristomium furrowed. First dorsal pore in 6/7 (slightly imperforate). Setae *a* and *b* absent from XVIII. Nephropore configuration: II-IV in *d* (R and L); V-VI in *c* (R and L); VII in *d* (R) or *c* (L); VIII-IX in *c* (R and L); X in *b* (R) or *d* (L); XI in *d* (R) or *b* (L), thereafter alternating regularly between *b* and *d* lines, though asymmetrically on each side of the body. Clitellum annular, strongly protruberant, in XIV-XVII; dorsal pores and intersegmental furrows obscured, nephropores and setae visible. Male genital field (refer to Fig. 1B): a series of conjoined or paired tumid pads in XVII-XXI, extending across the segment to slightly beyond *b*-lines on each side. Each tumescence contains a series of low, roughly circular nodules appearing as small glandular blisters. In XVII, the tumescences are paired, extending post-setally, with 2 pairs of nodules in the setal lines; in XVIII, the tumid pad fills the segment, with a line of 6 blister-like processes across the mid-segment. At the extremities of this series are the male pores, on very slight papillae, in *b*; immediately anterior to each pore is a further nodule. In XIX, the pads are paired; in XX, the pad is median, unpaired, with a set of 6 pre-setal nodules; similarly for XXI, with a pair of nodules (R) and set of 3 (1 faint) on the left. The tumid pads may be furrowed to a greater or lesser extent, or depressed at their centres. Additional markings: a single, unpaired median tumescence extending across *bb* in XII, filling the segment; the centre somewhat depressed, and containing a series of 5 more or less conjoined circular nodules or blisters across the midsegment; immediately ventral of the lateral rims of the tumescence are 2 larger glandular patches. Female pore a minute, unpaired median slit, barely pre-setal, in XIV. Spermathecal pores 2 conspicuous pairs in VIII and IX, slightly posterior to intersegments 7/8 and 8/9, on glandular papillae.

Septa: 5/6 thin, 6/7 slightly thickened, 7/8-10/11 highly muscularized and thickened; 11/12 moderately thickened, remainder thin. Dorsal blood vessel single, continuous onto the pharynx; supra-oesophageal vessel present, paired, in XI-XIII (though very faint in XI). Last hearts in XIII, commissurals in XI-XIII large and

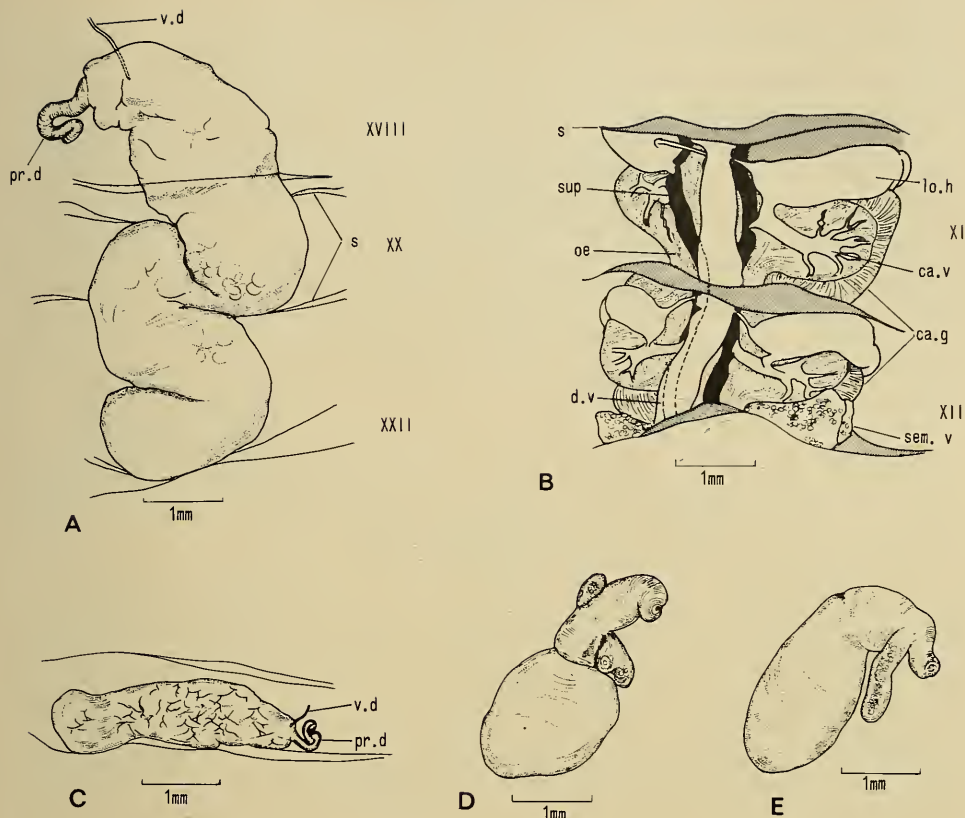


Fig. 2. A — *P. minyoni* right prostate gland *in situ* (H); B — *P. minyoni* dorsal aspect of gut vascularization in XI and XII (H); C — *P. clarkei* left prostate gland *in situ* (H); D — *P. minyoni* right spermatheca of IX (H); E — *P. clarkei* right spermatheca of IX (H).

heart-like, arising from a strong pair of connectives from the lateral calciferous vessels in XI-XII, and from long, much more tenuous connectives from the dorsal vessel (refer to Fig. 2B). The paired supra-oesophageal trunks connect the lateral calciferous vessels in XI-XIII, but the former are not discernible in X. Definite sub-oesophageal vessel apparently absent. Commissurals VI-X dorso-ventral only. Paired collecting vessels from the calciferous glands are present ventrally, and pass forwards through the septa, also sending branches to the body wall. Gizzard firm, muscular and barrel-shaped in V, with a comprehensive blood supply and distinct anterior rim. Oesophagus narrow, VI-XIV, becoming more dilated in the region of the calciferous glands. Three pairs of discrete, rounded-discoid calciferous glands vento-laterally disposed in XI-XIII, each with a definite, broad, dorso-lateral stalk connecting the gland to the oesophagus; the diameter of the stalk lumen as it communicates with the oesophagus is quite narrow, but broadens at the gland. The latero-calciferous trunks are adherent to, and begin to bifurcate, on the stalk. Intestine commences with abrupt expansion in XV, typhlosole absent. Stomate holonephridia throughout, each with collapsed semi-spherical bladders at the ectal extremes of their excretory ducts; these often appearing crinkled and/or bilobed. The ducts conspicuously alternate asymmetrically on each side of the body in the position of exit to the exterior.

Holandric; testis tissue (?), 2 medium-sized pairs of slightly plicate, iridescent sperm funnels, and some free sperm masses in X and XI; both these segments appear to be at least partially sealed dorsally by thin, pericardial testis-sacs. Two pairs of small seminal vesicle masses in IX and XII, the latter pair the larger, comprising small dorsally situated loculi grading into much larger, globose, ventral component loculi. Seminal vesicles in IX simple glandular sacs on the anterior wall of 9/10. Prostates somewhat sinuous S-shaped glands, tubular in appearance, extending into segment XXII (L). The duct is short and narrow, with a single loop. The fused vasa deferentia join the gland on the ventral surface some distance from the entry of the duct (refer to Fig. 2A). Small ovaries and small-medium funnels in XIII. Spermathecae 2 subequal pairs in VIII and IX, discharging anteriorly in their segments (refer to Fig. 2D). The larger of the two inseminated diverticula may be bilobed (as R IX) or uniloculate (remainder). Length right spermatheca of IX = 3.28 mm; ratio length spermatheca: length of duct = 2.08.

Material Examined: From 153° 24'E, 28° 37'S. Scrubland at the top of the Minyon Falls, Whian Whian State Forest, N.S.W.; (Locality data identical to that listed for *P. clarkei*) a single intact specimen, designated the Holotype (AM W6647), together with several anterior amputees not designated as types.

Remarks: The combinative possession of 3 pairs of calciferous glands, 2 pairs of spermathecae, and paired supra-oesophageal blood vessel is unique to this species. The affinities of *P. minyoni* with *P. clarkei* have been discussed under the relevant section for the latter species. Of considerable interest is the striking similarity between *P. minyoni* and a species of *Heteropodrilus* from the Lamington Plateau, S.E. Queensland, *H. lamingtonensis*. In addition to the close resemblance in the configuration and nature of the genital field markings, there is close conformation in a number of important internal characters, including the mutual possession of 3 pairs of calciferous glands, testis-sacs, and 2 pairs of spermathecae. Apart from the size discrepancy, nature of the calciferous glands (stalked or not), and some details of the vascular system, there is little to separate the 2 species. Although the specific status of either is not in doubt, their gross overall similarities serve to emphasize the tenuous nature of the generic distinction between *Plutellus* and *Heteropodrilus*.

The distribution of the latter genus is something of an enigma, for, though there is a great diversity of species in S.E. Queensland, and representatives in the basins of the Murray-Darling River systems, including a species from South Australia, *Heteropodrilus* has not been recorded from eastern New South Wales. Though the MacPherson Range intervenes between S.E. Queensland and N.E. New South Wales, no significant climatic, pedologic or floristic discontinuities that might hinder the spread of earthworm species are recognizable.

Plutellus notatus sp. nov.

Fig. 3 (A-E), Table 1.

l = 105, 85 mm; w (midclitellar) = 2.7, 2.4 mm; s = 232, 262. (H., P1). Uniformly circular in cross-section throughout, pigmentless buff in alcohol, clitellum pinkish. Prostomium tanylobous, peristomium narrow. First dorsal pore 6/7. Setae *a* and *b* absent from XVIII. Nephropores distinctly visible; in II-IV in *d*, V-VI in *c*, VII in *d*, VIII slightly lateral of *b*, thereafter a regular alternation between *d* and *b* lines.

Clitellum strongly developed, cingular, embracing segments XIV-XVII; dorsal pores obscured, setae, intersegmental furrows distinct. Male pores situated on small

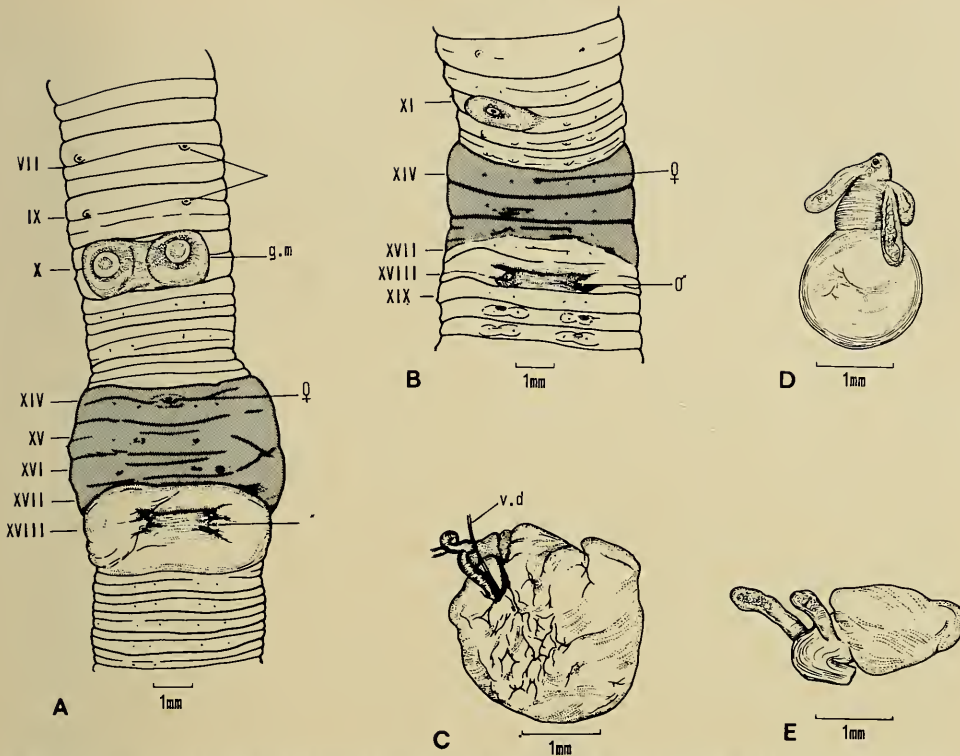


Fig. 3. *P. notatus*: A — genital field of Holotype; B — genital field of QM G8914; C — right prostate gland *in situ* (H); D — right IX spermatheca of QM G8914; E — right IX spermatheca of Holotype.

papillae in conspicuous depressions, in *ab*. The papillae are separated by a slightly raised intervening strip, and surrounded by a thick rim of highly tumescent tissue which incorporates XIX, and slightly overhangs XX. This tumid area extends beyond *b*, and forms a rough ellipse, with the male pores approximating the foci. Female pore unpaired, median, slightly presetal, in XIV. Spermathecae 2 pairs, opening in the midsegment of VIII and IX on small papillae, in *b*-lines. The left set of pores open posterior to the mid-segmental furrow, whilst the anterior set open anteriorly. Accessory markings: a single, highly tumescent swelling of bipartite appearance, the two portions with a central depressed 'dimple' region; this marking fills segment X longitudinally, extending laterally to *b*-lines.

Septa: 5/6 diaphanous, 6/7 moderately muscular, 7/8-10/11 strongly thickened and muscular, 11/12-13/14 slightly thickened. Dorsal blood vessel single, continuous to the pharynx. Last hearts in XIII; supra-oesophageal vessel absent. Hearts in ?X, XI-XIII apparently drain the lateral calciferous vessels directly, before the latter vessels fuse mid-dorsally as a contiguous loop. In X-XIII (P1), there appears to be a further, much smaller connective to the dorsal vessel (from the dorso-ventral commissurals). Calciferous glands with a moderate vascularization only (though the entire vascular system is somewhat bleached). Commissurals diminish rapidly in size anteriorad from X. Gizzard globular, slightly elongate, and highly muscular, (slightly compressible), in V. Oesophagus narrow, not vascular to any degree, excepting the final 5-6 segments. Four pairs of discrete ventro-lateral calciferous glands in X-XIII, their blood system bleached, the individual glands of each pair virtually contiguous,

and each with numerous, well-developed lamellae. The glands are connected to the oesophagus by medium-length, stout, dorsolateral stalks, these appearing, at least superficially, to be more highly vascularized than the glands themselves. Intestine commences in XXI (H) or XVI (P1, 2), typhlosole and caeca absent. Nephridial ducts terminate in conspicuous ovoid bladders, which discharge through a wide tube to the exterior; the bladders themselves are rather diaphanous and collapsed, with little variation in shape. Nephridial funnels and necks lie transversely in the segment preceding, in *a*-lines, the neck running transversely to *b*, then dipping into the setal line, and running posteriad through the septum to join the nephridial body. Holandric; 2 pairs of large, iridescent funnels and coagulated sperm masses, seemingly enclosed in a very thin membrane under the oesophagus, in X and XI. Seminal vesicles 2 prominent pairs, with large component loculi, in IX and XII, with a pair of smaller agglomerations just anterior to the funnels in XI. Vasa deferentia visible as single iridescent ducts on each side, not tortuously winding, joining the prostate gland at the point of insertion of the duct. Prostate glands roughly squarish lobes, conspicuously fissured, extending from XVIII into XIX. Duct long, narrow and muscular, somewhat coiled, entering the parietes in XVIII (refer to Fig. 3C). Ovaries, comprising a racemose cluster of smallish oocytes, and a large folded funnel close to the nerve-cord on each side in XIII. The oviducal ducts are visible passing through septum 13/14, and fusing just prior to entering the parietes under the nerve-cord. Spermathecae 2 pairs in VIII and IX, discharging into the midsegment. Each comprises a conico-sacciform ampulla, and long, stout duct, which is bent through an acute angle before entering the body wall. From either side of the ental region of the duct arise 2 subequal, digitiform diverticula, each containing what appear to be a number of brightly iridescent sperm clusters (refer to Fig. 3D, E). Length right spermatheca of IX = 2.8 mm; ratio length spermatheca: length of duct = 2.3; ratio length of spermatheca: length diverticula (mean) = 2.75.

Material Examined: From 152° 55'E, 26° 25'S. Six Mile Creek, near Cooroy; under ferns in riverine rainforest, near creek bank. Coll. G. Dyne and J. Wampler, 3 Feb 1978. Holotype (AM W6648). Same locality, coll. G. Dyne and M. Williams, 27 June 1976. Paratypes 1 and 2 (QM G8914-5).

Remarks: The possession of two pairs of spermathecae and four pairs of calciferous glands serves to distinguish this species, which, together with *P. raveni* and *P. incommodus*, defines a northerly extension of the generic range. Like the latter two species, *P. notatus* has racemose prostate glands (as in *Heteropodrilus*), in contrast to the tubular or tubulo-racemose organs found in the remainder of the genus (and *Paraplutellus*). In other respects, however, *P. notatus* is morphologically dissimilar to the other Queensland *Plutellus* species.

DISCUSSION

Apart from *Plutellus s. strict.* itself, only 2 other Australian genera may be referred to as being truly 'plutelloid', or, more satisfactorily, as 'heteropore'. These are *Paraplutellus*, an insular, monotypic genus from Lord Howe Island, characterized by an unusually anterior commencement of nephropore alternation, and restriction of the calciferous glands to a single pair, in XIII; and *Heteropodrilus*, which differs from *Plutellus* consistently only in the possession of sessile, rather than stalked, calciferous glands. A number of other Australian species, previously confined within the broadly defined classical *Plutellus*, have largely been redistributed amongst

genera such as *Simsia* and *Graliophilus*, now more appropriately regarded as 'Diporochaetoid'.

In consideration of morphological trends seen elsewhere within the Megadriles, and the more widespread distribution of the sessile-glanded forms, it seems justifiable to consider the stalk-glanded *Plutellus* as the more derived genus. In Hennigian terms, *Heteropodrilus* would be seen as the plesiomorph sister-group of *Plutellus* s. strict. Although close resemblances have been demonstrated between different species across the two genera (e.g. *P. minyoni* and *H. lamingtonensis*), with the possibility of the existence of truly intermediate forms, maintaining the two assemblages as distinct entities is probably warranted, in that the calciferous arrangement of *Plutellus* s. strict. represents a discrete apomorphic divergence that has attained fixation in a number of divergent species.

As Jamieson (1977) suggests, *Paraplutellus* appears to be yet further derived, having lost the gizzard, and reduced the calciferous gland series to a single pair, perhaps secondarily sessile. Wallace (1972), in a numerical analysis of 49 'plutelloid' species from Australia and North America, employing 36 characters over 95 character states, found a consistent cohesion of the *Plutellus* — *Heteropodrilus* — *Paraplutellus* group, as distinct from clusterings identifiable as *Simsia* — *Graliophilus* and *Diporochaeta* — *Fletcherodrilus* groups. Wallace (1971) also notes that the former assemblage is 'remarkably homogeneous' with respect to nephridial characters such as nephropore arrangement, vesicle shape, lack of pharyngeal tufting, and overall morphology.

Detailed interpretation of the fate of the large extra-Australian residue of species created by the restriction of *Plutellus* must be deferred, but clearly, the North American species analysed in the above computational study which segregated at a high level of dissimilarity from other groupings into a well-defined cluster, appear to demand generic identity. In an independent assessment, Gates (1972) resurrected Eisen's genus, *Argilophilus*, ostensibly to absorb North American forms, and comments further: 'Burmese, if not all Oriental species (of *Plutellus* s. lat.) can go better into *Argilophilus* than any genus of which *heteroporus* is the type-species'. These, like the American species, lack calciferous glands, but the reservations conceded by the same author (op. cit.), namely the apparent further excretory modifications of the oriental worms and 'the vast oceanic gap', also deserve consideration.

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APPENDIX

ABBREVIATIONS USED IN THE TEXT AND FIGURES

AM	Australian Museum	s	septum
ca.g.	calciferous gland	s(descr)	number of segments
ca.v	calciferous vessel	sem.v	seminal vesicle
d.v.	dorsal vessel	sp.p	spermathecal pore
g.m.	genital marking	sup	supra-oesophageal vessel
lo.h	latero-oesophageal heart	v.d	vas deferens
l	length	w	width
oe	oesophagus	♂	male pore
pr.d	prostatic duct	♀	female pore
QM	Queensland Museum		